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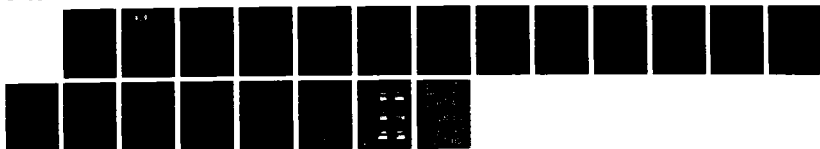
EFFECTS OF DIFFERENT RESISTANCE EXERCISE PROTOCOLS ON  
MOOD STATES(U) ARMY RESEARCH INST OF ENVIRONMENTAL  
MEDICINE NATICK MA W J THARION ET AL. 29 APR 88

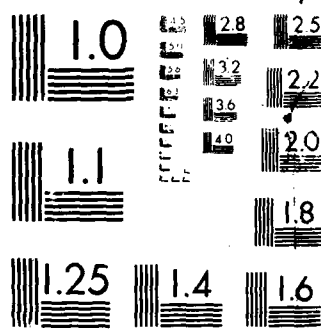
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**Title:**

Effects of Different Resistance Exercise Protocols on Mood States

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## Abstract

Moods of 9 males and 9 females were examined before and after 6 different weight lifting workouts, varied according to inter-set rest interval (1 vs. 3 min.), total work (low vs. high), and weight lifted (heavy for 5 reps. per set vs. light for 10 reps. per set). The Profile of Mood States was given 2 min. pre-, and 2 mins., 2 hrs., 24 hrs. and 48 hrs. post-workout. Higher subjective feelings of negative moods including tension, depression and fatigue resulted from high work, lower weight with higher reps. per set, and short inter-set rest period. Lighter weight with higher total work produced more tension and depression with 1 than 3 min. rest, probably due to physical fatigue. In contrast, a heavier weight with lower work produced more tension and depression with 3 than 1 min. rest, possibly because of impatience about 3 minute rest periods when fatigue was minimal.



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There has been considerable research devoted to the assessment of mood states associated with exercise. Morgan and Pollock (1977) examined the psychological characteristics of elite runners using the Profile of Mood States (POMS) (McNair, Lorr, & Droppleman, 1981). The POMS measures six affective states: tension, depression, anger, vigor, fatigue, and confusion. Elite runners reported higher subjective feelings of vigor compared to college norms and lower than college norms for the five negative moods. Morgan and Pollock (1977) referred to the shape of the standard plot of athlete's mood scores as the "iceberg profile." In subsequent studies the "iceberg profile" has been reported in wrestlers (Morgan & Johnson, 1977), rowers (Morgan & Johnson, 1978), non-elite runners (Gondala & Tuckman, 1982), swimmers (Berger & Owen, 1983), and ultramarathoners (Tharion, Strowman & Rauch, 1988).

Research over the past decade has been focused on changes in mood states before and after physical exercise (Dishman, 1985; Folkins, 1976; Folkins & Sime, 1981; Gondala & Tuckman, 1982; and Johnson & Morgan, 1981). Most of the studies to date have assessed mood states immediately before and after acute bouts of physical exercise or before and after chronic exercise programs lasting 6-20 weeks. The exercises studied were primarily aerobic in nature, such as running, aerobic-dance, calisthenics and swimming. Both acute and chronic exercise programs resulted in improved affective states including lower levels of depression (Dishman, 1985).

While it has been shown that regular weight training improves self and body concepts (Brown & Harrison, 1986; Trujillo, 1983; Tucker, 1982, 1983a, 1983b), few studies have dealt with the effects of resistance exercise on mood states. Dishman and Gettman (1981) reported that a 20-week circuit weight training program significantly increased vigor and physical esteem. The purpose of the present study was to examine acute changes in mood states

associated with resistance workouts, and more specifically to determine changes in mood states associated with various levels of rest, work load, workout intensity, and gender.

### Methodology

Nine male and nine female physically active subjects between the ages of 19 and 35 with varied athletic backgrounds volunteered to participate in the study. Six different resistance exercise protocols, summarized in Table 1, were used.

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Insert Table 1 about here

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Of the six programs there were two primary workouts, A and B. The A workout was a five repetition maximum (RM) based workout which incorporated longer rest intervals (three minutes) and greater weight lifted than the B workout. The B workout was a 10 RM based workout with one minute rest between sets. The A type workout is normally used in "strength" training while the B type workout is used for body-building or to improve local muscle endurance. The A1 workout was the same as the A workout in total work and inter-set rest period (three minutes). However, subjects used a lighter weight, so that they could perform 10 instead of five repetitions per set. The A2 workout was the same as the A workout in total work and repetitions, with the variation being in the inter-set rest period (one minute instead of three minutes). The B1 and B2 workouts followed the variations of the A series (i.e. varying rest and



work intensity). All A workouts were equivalent in total amount of work performed as were all the B workouts. However, the total amount of work performed was less in the A series than the B series.

The matching of total work between workouts was performed by a computer program which, given a specific exercise, weight, and number of repetitions, calculated the number of repetitions required to produce the same total work using a different weight. Lifting work was calculated as weight times vertical distance moved per repetition times number of repetitions. The program took into consideration the vertical distance moved of both the iron plates and the centers of gravity of the lifter's body segments. These distances were obtained from measurements on the subjects and equipment when they were in the starting and ending exercise positions. Anthropometric tables (Winter 1979) were used to locate body segment centers of gravity and estimate body segment weights from total body weight.

The exercises were performed in the following order: bench press, double leg extension, military press, weighted situps, pull-downs, seated rows, preacher arm curls, and leg press. All exercises were performed on Universal (Cedar Rapids, Iowa) equipment with the exception of preacher arm curls and weighted situps for which free weights were used. Workout loads (5 RM and 10 RM) were determined using the standard procedures described by Delorme and Watkins (1948, 1951) and Berger (1962). All subjects received instruction in the 10 exercises prior to the actual study.

All experimental workouts were held at the same time of the day, to minimize possible diurnal variations. Women (eumenorrheic) were scheduled for the workout sessions during the follicular phase (exercise on days 2 and 5) of the menstrual cycle, determined according to methods previously described by Loucks and Horvath (1984). None of the subjects were using any hormonal

medication or treatment (e.g. oral contraceptives or anabolic steroids) for one year prior to participation in the study.

Mood states of subjects were assessed two minutes pre-, two minutes post-, two hours post-, 24 hours post-, and 48 hours post-workout using the POMS, a 65-item adjective questionnaire. Each item is rated on a five point scale from feelings of "not at all" to "extremely". Subjects indicated how they felt "right now" for each item. The six mood states assessed were tension, depression, anger, vigor, fatigue and confusion.

Results were analyzed by repeated-measures multivariate analysis of variance, using an alpha level of .05. The five independent variables analyzed included total work ( A Series vs. B Series), work intensity (5 RM vs. 10 RM), rest interval (1 min. vs. three min.), sex, and administration.

### Results

The pre-exercise subject mood plots showed the classic iceberg profile found in many athletic populations. Figure 1 shows the mood scores expressed as T-score values to provide comparison to college norms and to compare the relative intensities of the different moods.

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Insert Figures 1 and 2 about here

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Mood changes by administration are depicted in Figure 2. There was a significant interaction effect between rest interval and administration for

feelings of fatigue  $F(4,13) = 3.61, p < .03$ . For the two minutes pre, 24 hours post and 48 hours post there was virtually no difference in feelings of fatigue between the two rest intervals. However, two minutes post as well as two hours post, fatigue was considerably higher for the shorter rest interval (1 min.). There was a significant main effect of rest interval on fatigue  $F(1,16) = 7.58, p < .02$ , with the shorter rest interval producing more fatigue. Significant differences existed between the combination of one min. rest and higher total work, and the combination of three min. rest and lower total work,  $F(1,16) = 18.60, p < .001$  as well as between the combination of 10 RM weight and 1 min. rest and the combination of 5 RM weight and 3 min. rest,  $F(1,16) = 6.78, p < .02$ . More fatigue was experienced with shorter rest in combination with either more total work or more repetitions. After workouts with one min. rest, fatigue was greater than that for workouts with three mins. rest for up to two hours.

Depression was significantly higher with greater work  $F(1,16) = 5.86, p < .03$ . Significant interaction effects existed between RM and rest interval for tension  $F(1,16) = 4.55, p < .05$ , and depression  $F(1,16) = 4.76, p < .05$ ; the combination of a 10 RM weight and higher total work produced more tension and depression with one minute rest than with three minutes, while the combination of five RM and lower total work produced more tension and depression with three minutes rest than with one minute. Most probably, the cause of tension and depression in the higher work group with one minute rest was physical fatigue, while the cause for these negative moods in the lower work group may have been impatience about mandatory three minute rest periods when fatigue was minimal. Total time for workouts incorporating three minute rest periods was considerably more than for workouts with one minute rest periods.

Males reported to be significantly more vigorous than females  $F(1,16) = 6.34, p < .02$ . No other main or interaction effects were realized with respect to feelings of vigor.

Finally, females reported to be significantly more confused than males  $F(1,16) = 6.68, p < .02$ . There was also a significant main effect for administration on confusion  $F(4,13) = 3.35, p < .04$ , where confusion was reduced 24 hours after completing the workout.

### Discussion

The results reveal that the negative mood feelings of tension, depression, and fatigue are all associated with the B workout. The B workout consisted of more total work, less rest and more repetitions at a slightly lower weight load. Individuals beginning a weight training program must decide why they are lifting and what they hope to achieve. There are distinct physiological benefits to be derived from each program. However, if the goal is to build self-esteem and generally good mental health through weight training, the A workout is an easier route than the B workout. However, an A type workout requires more time to perform the same amount of work. Individuals utilizing the B workouts probably have to be more creative in workout design to provide reinforcement for maintenance of a positive attitude. With a lower RM workout the individual is reinforced by seeing more progress in the amount of weight moved. It is likely that lifting more weight is a stronger reinforcer than completing a greater number of repetitions at a lower weight load.

Another possibility is that the B workout requires a higher overall fitness level than the A workout, due to its shorter rest period, greater

total work and more repetitions. Thus, the psychological benefits from the B workout may come only after a certain level of physical conditioning is attained, and workout induced fatigue is lessened. In the A workout the individual is primarily limited by physical strength, due to the heavier weight that must be lifted. With the B workout, overall physical conditioning is the main limitation. Subjects were not pre-trained for either workout, but the B workout appears to have been more taxing for the untrained. It may be that individuals, trained for a period of time with the contrasting types of workouts, would show no differences in mood state.

Supporting this hypothesis is a study by Folkins, Lynch, and Gardner (1972) which reported that psychological fitness is tied to physical fitness, although a cause-effect relationship has not been demonstrated. They hypothesized that improvements in psychological fitness may be the result of improvements in physical conditioning. Furthermore, they suggested the effect may be the result of feedback from the heart, muscles and limbs.

It must be noted that the negative mood states were all well below what is found in college norms. Therefore, the greater depression scores associated with the type B over the type A workout does not mean the individuals were in a depressed state but rather that the A workout had a greater attenuating effect on depression than did the B workout.

Males exhibited more positive mood states during and after weight training than did females, showing slightly more vigor and less confusion. These differences may have been due to greater experience and familiarity among males than females with recreational resistance exercise.

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NOTE ON U.S. ARMY HUMAN RESEARCH

Human subjects participated in these studies after giving their free and informed voluntary consent. Investigators adhered to AR 70-25 and USAMRDC Regulation 70-25 on Use of Volunteers in Research.

The views, opinions, and/or findings contained in this report are those of the authors and should not be construed as an official Department of the Army position, policy or decision.

We gratefully acknowledge the assistance of Scott Lawley in the data collection and Donna Boucher in the graphics preparation.

Table 1

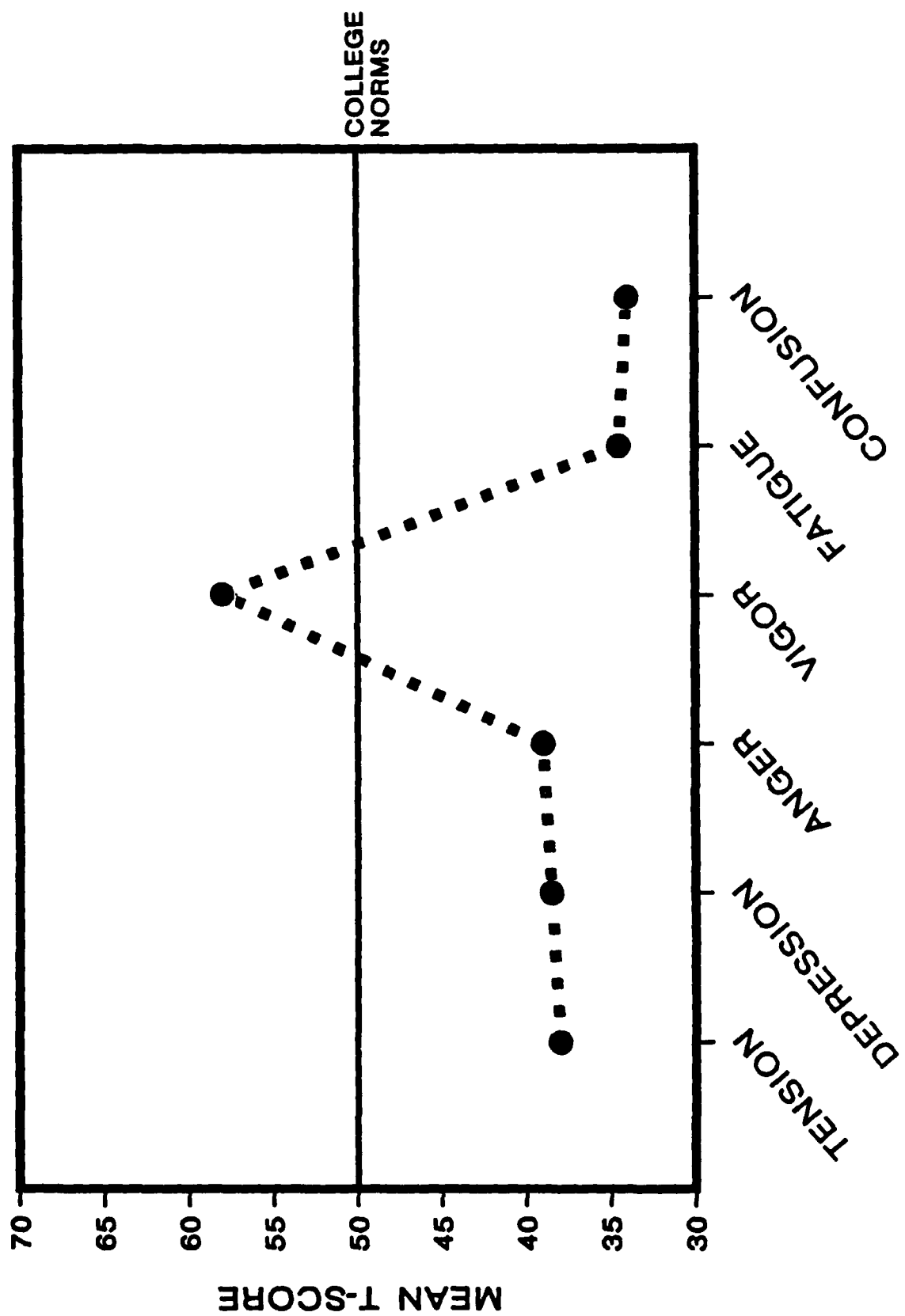
Workout Regimens for the Six Resistance Exercise Protocols

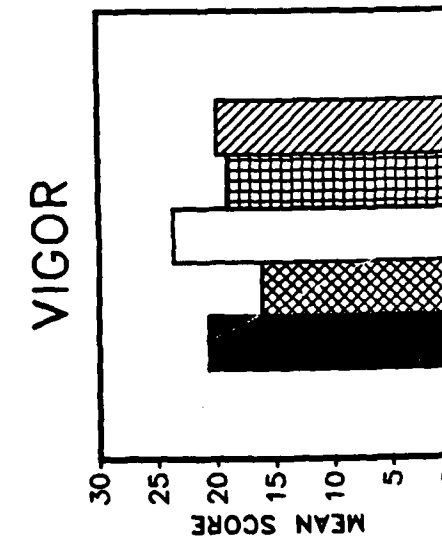
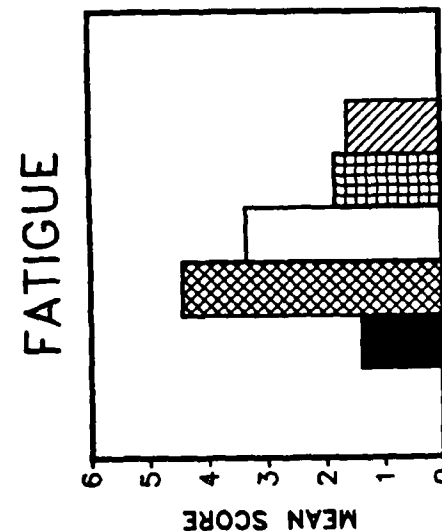
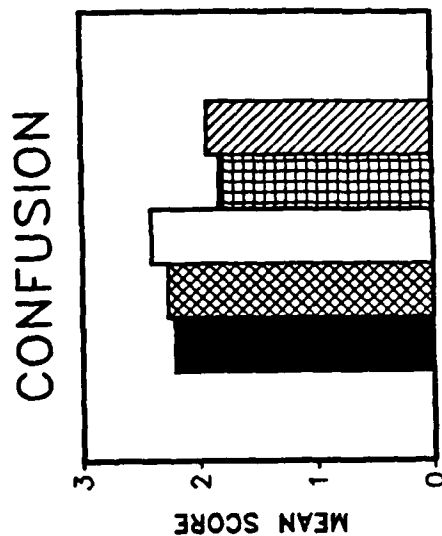
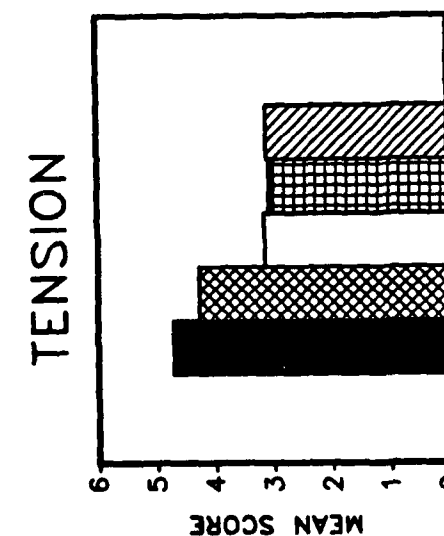
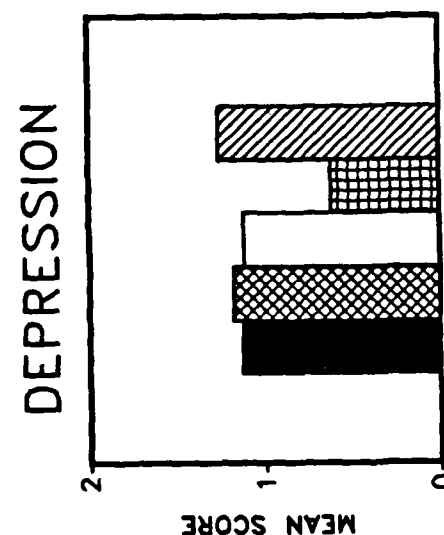
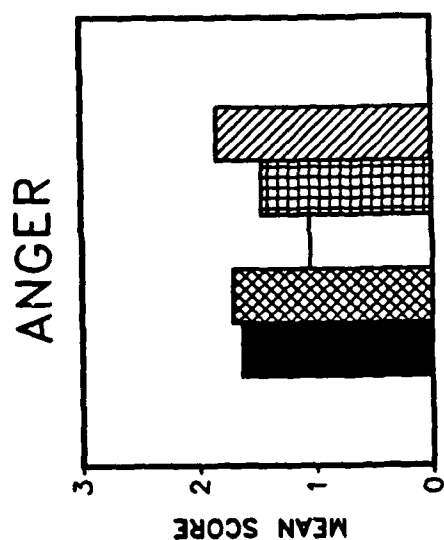
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Workout	Repetitions Per Set	Rest (Min)	Total Work	
A	5	3	Low	
A1	10	3	Same as A	
A2	5	1	Same as A	
B	10	1	High	
B1	5	1	Same as B	
B2	10	3	Same as B	

TEXT TO FIGURES

Figure 1. Pre-workout average mood state profile.

Figure 2. Average mood state raw scores by administration.





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